

**A new crayfish of the genus *Orconectes* Cope, 1872 from the lower
Ohio River drainage of western Kentucky
(Crustacea: Decapoda: Cambaridae)**

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Abstract—A new crayfish, *Orconectes margorectus*, is described from the lower Ohio River drainage of western Kentucky. The species occurs in small streams with substrates of gravel and cobble. Form I males of *O. margorectus* differ from all other members of the genus *Orconectes* Cope in possessing a mandible with a straight incisor region and a first pleopod with straight terminal elements that comprise 24 to 28% of the total length of the pleopod.

An ongoing systematic study of the subgenus *Crockerinus* Fitzpatrick, 1987, genus *Orconectes* Cope, 1872, using both molecular and morphological data revealed the presence of an undescribed species of crayfish in the lower Cumberland and Ohio river drainages of western Kentucky. Subsequent examination of material housed at the National Museum of Natural History, Smithsonian Institution, and the Illinois Natural History Survey indicated that this undescribed form had been previously identified as *Orconectes tricuspis* Rhoades, 1944, a species that occurs immediately upstream of the new form in the Cumberland River drainage. Based on the morphology of the form I male pleopod, this new species described herein is assigned to the Rafinesquei group (Fitzpatrick 1987) of the subgenus *Crockerinus*. Members of the Rafinesquei group inhabit lotic habitats and are distributed across the western half of Kentucky and extreme southern Illinois. Fitzpatrick (1987) included the following as members of the Rafinesquei group: *Orconectes bisectus* Rhoades, 1944, *O. illinoensis* Brown, 1956, *O. rafinesquei* Rhoades, 1944, *O. tricuspis*. Taylor & Sabaj (1998) later added *O. burri* Taylor & Sabaj, 1998 to this group.

Orconectes margorectus, new species
Figs. 1, 2A, Table 1

Diagnosis.—Body and eyes pigmented. Rostrum deeply excavated, terminating in long acumen; median carina absent. Rostral margins thickened; margins straight, subparallel and slightly converging (see Variation); terminating in spines (Fig. 1A). Areola 30.4–35.2% ($\bar{X} = 32.8$, $n = 28$, $SD = 1.2$) of total length of carapace (CL = distance from distal tip of acumen to dorso-caudal edge of cephalothorax), narrowest part at midpoint, 4.9–10.5 ($\bar{X} = 8.0$, $n = 28$, $SD = 1.3$) times as long as wide with 3 to 5 (mode = 3, $n = 28$, $SD = 0.5$) punctations across narrowest part (Fig. 1A). One corneous cervical spine on each side of carapace (Fig. 1A). Postorbital ridges well developed, terminating in corneous spines (Fig. 1A). Suborbital angle weakly developed, forming broadly rounded projection. Antennal scale broadest distal to midlength, thickened lateral margin terminating in large corneous spine (Fig. 1B). Ischia of third pereopods of males with hooks; hooks overreaching basioischial articulation in form I males only. Chela with 2 or 3 rows of tubercles (see Variation) along mesial margin of palm, usually 8 or 9 tubercles in mesialmost row and 7 or 8 in dorsome-

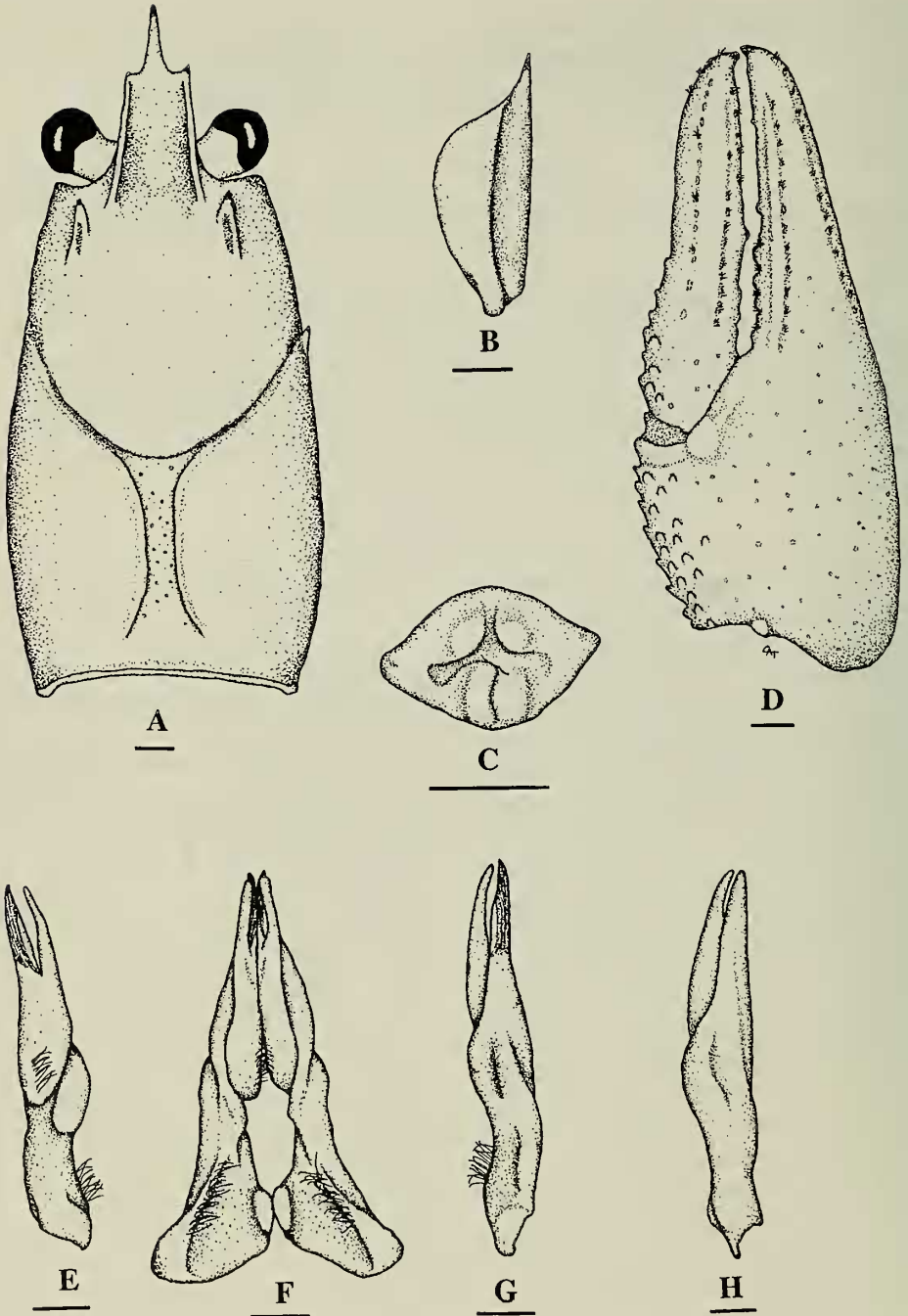


Fig. 1. *Orconectes margorectus*, new species: A, Dorsal view of carapace; B, Dorsal view of right antennal scale; C, Annulus ventralis; D, Dorsal view of right chela; E, Mesial view of first pleopod of form I male; F, Caudal view of first pleopods of form I male; G, Lateral view of first pleopod of form I male; H, Lateral view of first pleopod of form II male. A, B, D E, F, and G of holotype (INHS 8398); H, morphotype (INHS 8396); C, allotype (INHS 8395). Scale bars equal 1 mm.

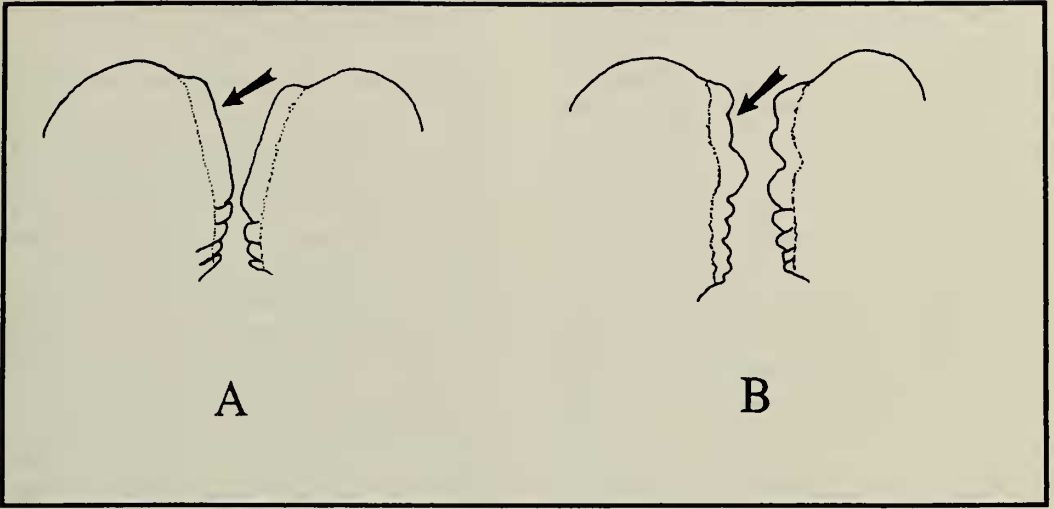


Fig. 2. Incisor region (arrow) of mandibles. A, straight edge, as found on *O. margorectus*, new species. B, Serrated edge, as found on most other species of the subgenus *Crockerinus*. After Bouchard (1978).

sial row; small tufts of setae along opposite margins of fingers; dorsal surfaces of fingers with well defined longitudinal ridges (Fig. 1D). Mandible with straight edged incisor region (Fig. 2A). Cephalomedian lobe

Table 1.—Measurements (mm) of *Orconectes margorectus*, new species.

	Holotype	Allotype	Morphotype
Carapace:			
Total length	27.0	22.6	28.2
Postorbital			
length	19.6	17.0	21.4
width	12.7	11.2	14.5
height	10.4	9.0	10.4
Areola:			
width	1.1	0.9	1.4
length	8.5	7.2	9.4
Rostrum:			
width	3.4	2.8	3.5
length	8.5	6.7	8.0
Chela, right:			
Length, palm			
mesial margin	6.4	4.4	5.7
palm width	7.9	5.9	7.8
Length, lateral			
margin	20.3	14.4	21.0
dactyl length	12.4	8.4	13.7
Abdomen:			
width	11.5	11.7	11.8
length	28.2	24.0	30.4

of epistome triangular with small, triangular cephalomedian projection; epistomal zygoforma forming weak arch. First pleopods of form I male symmetrical (Fig. 1F), extending to posterior edge of bases of second pereopods when abdomen flexed. First pleopod of form I male without shoulder on cephalic surface at base of central projection; central projection corneous, constituting 23.6–27.9% ($\bar{X} = 25.0$, $n = 15$, $SD = 1.3$) of total length of first pleopod, continuous with main shaft of pleopod, tapering to a pointed tip, tip slightly arched caudodistally; mesial process equal to or slightly subequal (see Variation) in length to central projection, non-corneous, tapering to an acute tip, tip arched caudomesially (Fig. 1E, G). First pleopod of form II male non-corneous, extending to posterior edge of bases of second pereopods when abdomen flexed; central projection straight, mesial process arched slightly caudomesially and subequal in length; both elements tapering to rounded tips (Fig. 1H). Annulus ventralis immovable, subrhomboidal; cephalic half with wide median trough and 2 caudally directed protuberances overhanging centrally located fossa; sinuate sinus running from center of fossa to caudal edge (Fig. 1C).

Description of holotypic male, form I.— Body slightly depressed dorsoventrally, carapace wider than abdomen (12.7 and 11.5 mm, respectively). Greatest width of carapace larger than height at caudodorsal margin of cervical groove (12.7 and 10.4 mm, respectively). Postorbital carapace length 72.6% of total length of carapace. Areola 7.7 times longer (8.5 mm) than wide (1.1 mm) with 3 punctations across narrowest part; length of areola 31.5% of total length of carapace. Rostrum deeply excavated dorsally, floor smooth, lacking carina; margins thickened; straight and slightly converging, terminating in corneous spines (left spine broken off). Acumen long and terminating in corneous spine, reaching just posterior to distal margin of third antennal endopod. Postorbital ridges well developed, terminating in corneous spines. Suborbital angles absent. Right cervical spine corneous, left spine broken off; dorsal and branchiostegal areas of carapace densely punctate.

Abdomen longer than carapace (28.2 and 27.0 mm, respectively). Cephalic section of telson bearing 2 spines in each caudolateral corner, more mesial pair movable. Proximal podomere of uropod with spine extending over mesial ramus and spine in caudolateral corner extending over lateral ramus. Caudal margin of cephalic section of lateral ramus with 13 fixed spines and 1 movable spine in caudolateral corner, lateral ramus with median ridge terminating in spine. Lateral margin of mesial ramus terminating in spine; mesial ramus with prominent median ridge terminating in premarginal spine. Dorsal surfaces of telson and uropods setiferous.

Antennal scale as in Diagnosis. Right antennal scale 6.6 mm long, 2.4 mm wide. Epistome as in Diagnosis.

Mesial surface of palm of right chela with 3 rows of tubercles, 8 tubercles in mesialmost row, 9 tubercles in second dorsomesial row, and 5 tubercles in third dorsomesial row; 7 small interspersed tubercles lateral to third dorsomesial row. Mesial and lateral surfaces of chela and opposable mar-

gins of fingers covered with numerous setiferous punctations; dorsal and ventral surfaces with scattered punctations. Dorsal surface of finger of propodus with submedian longitudinal ridge flanked by setiferous punctations; basal half of opposable margin with 5 tubercles which gradually increase in size, fifth tubercle from base of finger largest, 1 small corneous tubercle just distal to midlength between fifth tubercle and distal tip of finger. Dorsal surface of dactyl with submedian longitudinal ridge flanked by setiferous punctations; basal half of opposable margin with 8 weakly developed tubercles, 7th tubercle from base of dactyl slightly larger than remaining 7, seventh and eighth tubercles corneous. Finger of propodus and dactyl with subterminal corneous tip.

Right carpus with deep oblique furrow dorsally; dorsal surface with 1 large corneous spine at distolateral corner; mesial margin with 1 large corneous procurved spine at midlength; ventral surface with 1 large corneous spine just lateral to midlength of distal margin, 1 large spine just mesial to midlength of distal margin. Dorsodistal surface of merus with 1 large corneous spine; ventral surface with 1 large corneous spine at distolateral corner (left merus with 2 large corneous spines in distolateral corner) and mesial row of 10 spines; row terminating in large corneous spine. Ischium with 1 corneous spine just proximal to midlength of mesial margin and 1 large tubercle on distal end of mesial margin.

Hook on ischium of third pereopod only; hook simple, overreaching basioischial articulation, not opposed by tubercle on basis. First pleopod of form I male without shoulder on cephalic surface at base of central projection; central projection corneous, constituting 25.6% of total length of first pleopod, parallel to main shaft of pleopod, tapering to pointed tip, tip not arched caudadistally; mesial process slightly subequal in length to central projection, non-corneous, tapering to acute tip, tip arched cau-

domesially and dorsoventally flattened (Fig. 1E, G).

Description of allotypic female.—Differing from holotype as follows: Areola constituting 31.9% of length of carapace and 8 times longer than wide. Postorbital carapace length 75.2% of length of carapace. Abdomen wider than carapace (11.7 and 11.2 mm, respectively). Right cheliped detached. Mesial surface of palm of right chela with 2 rows of tubercles, 8 tubercles in mesialmost row and 7 tubercles in dorsomesial row. Tuft of long setae at base of finger of propodus. Caudal margin of cephalic section of lateral ramus of uropod with 15 fixed spines.

Sternum between third and fourth pereopods narrowly V-shaped. Postannular sclerite 0.75 as wide as annulus ventralis (described in Diagnosis). First pleopod uniramous, barely reaching caudal margin of annulus when abdomen flexed.

Description of morphotypic male, form II.—Differing from holotype as follows: Proximal halves of rostral margins slightly convex. Areola constituting 33.3% of length of carapace, 6.7 times longer than wide, and with 4 punctations across its narrowest part. Postorbital carapace length 77.5% of length of carapace. Mesial surface of palm of right chela with 2 rows of tubercles, 8 tubercles in mesialmost row and 8 tubercles in dorsomesial row. Ventral surface of merus with mesial row of 8 spines.

Hook on ischium of third pereopod not overreaching basioischial articulation. First pleopod as described in Diagnosis.

Size.—The largest specimen examined is a 44.7 mm CL form I male. Females ($n = 10$) range in size from 13.6 to 37.9 mm CL. Form I males ($n = 18$) range from 16.3 to 44.7 mm CL. Form II males ($n = 20$) range from 14.2 to 41.6 mm CL.

Color.—Base color of dorsal and lateral surfaces of chelae, cephalothorax, abdomen, and tail fan light brown to olive green. Dark dorsal blotches just anterior of cervical groove and at caudal margin of cephalothorax visible on freshly mottled individ-

uals. Dorsal surfaces of abdominal segments dark and usually flanked laterally by tan to light orange colored regions. Dorsal knob at base of dactyl, tubercle at chela/carpus articulation joint, and spines on carpus and merus light orange or cream colored. Dorsal surfaces of chelae covered with small dark flecks. Dark narrow stripe along lateral margin of chelae. Fingers of chelae with orange tips followed proximally by wide black bands. Dorsal surfaces of pereopods olive green. Ventral surfaces of chelae, cephalothorax, and abdomen cream to white.

Type locality.—Ferguson Creek at Kentucky Hwy. 70, 3.2 km E Smithland, Livingston County, Kentucky. Holotype was collected from under a piece of flat cobble, approximately 2 m downstream of the bridge. Ferguson Creek is a small, spring-fed tributary of the lower Cumberland River and, at the time of collection (11 April 2001), ranged in width from 3–6 m with an average depth of 0.3 m. Upstream of the bridge, stream morphology was primarily shallow (0.1–0.2 m deep) gravel bottomed riffles. An area of large flat cobbles occurred approximately 5 m upstream of the bridge. Downstream of the bridge, stream morphology was primarily deeper (0.2–0.4 m deep) runs with a variable substrate composed of a combination of gravel, flat cobble, and mud/sand. Stream banks were well vegetated and surrounding land was densely wooded. The allotype and morphotype were collected from the type-locality on 10 October 1972 and 29 May 1972, respectively.

Disposition of types.—The holotype, allotype, and morphotype are deposited in the Illinois Natural History Survey Crustacean Collection as INHS 8398, INHS 8395, and INHS 8396, respectively, as are the following paratypes: 5 ♂ I, 3 ♂ II, and 2 ♀, INHS 8397. Paratypes are deposited at the National Museum of Natural History, Smithsonian Institution, Washington, D.C. as follows: 2 ♂ I, USNM 310296 and 1 ♀, USNM 310297. The localities and dates of

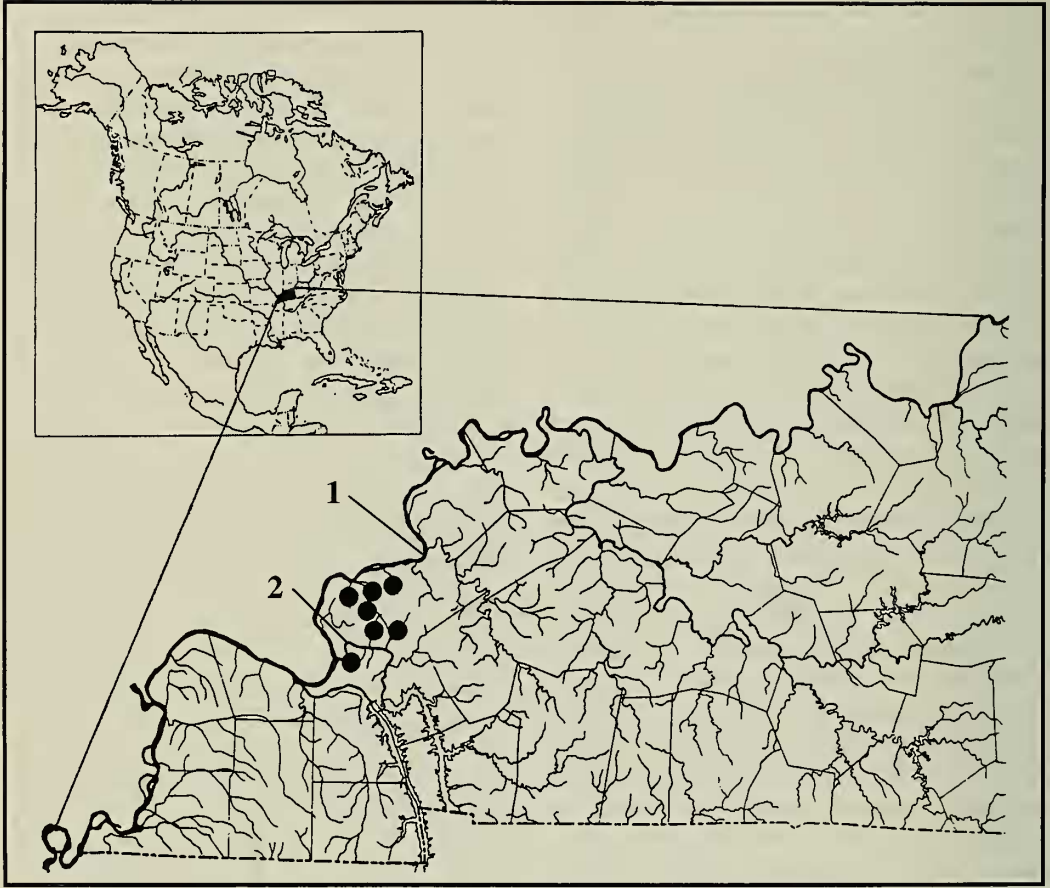


Fig. 3. Known range of *Orconectes margorectus*, new species. 1 = Ohio River, 2 = Cumberland River.

collection are provided in the following Range and specimens examined section.

Range and specimens examined.—*Orconectes margorectus* new species, occurs in small tributaries of the extreme lower Cumberland and Ohio river drainages of the Interior Low Plateaus physiographic province in western Kentucky (Livingston and Crittenden counties) (Fig. 3). In the lower Cumberland River drainage the species is known from the Claylick, Sandy, and Ferguson creek drainages, all of which occur in the Western Highland Rim Subsection of the Highland Rim Section (Burr & Warren 1986). Sandy and Claylick creeks occur on the north side of the Cumberland River and drain interbedded limestones, sandstones, and shales and limestones of Mississippian

age. Ferguson Creek is a northern flowing tributary on the south side of the Cumberland and drains sandstones and limestones of Mississippian age. In the Ohio River drainage the species is only known from the Buck, Deer, and Hurricane creek drainages, which occur in the Marion Subsection of the Shawnee Hills Section (Burr & Warren 1986). Buck, Deer, and Hurricane creeks also drain interbedded limestones, sandstones, and shales and limestones of Mississippian age. Extensive collecting in western Kentucky and neighboring southern Illinois by the author and others and a search of holdings in the National Museum of Natural History and the Illinois Natural History Survey Crustacean Collection have failed to document the presence of *O. margorectus*

outside of the above mentioned range. In tributaries of the Ohio River immediately east of the Coefield-Deer Creek drainage, the species is replaced by *Orconectes (Crockerinus) bisectus* Rhoades, 1944. More upstream tributaries of the Cumberland River found directly south of the range of *O. margorectus* contain *O. (Crockerinus) tricuspis* Rhoades, 1944. Because *O. margorectus* does not occur in neighboring southern Illinois, the Ohio River to the north of its range has probably acted as a barrier to dispersal for this species. Lowland habitat of the Coastal Plain Physiographic province found directly west of the range of *O. margorectus*, presumably inappropriate habitat for the species, probably has prevented its dispersal in that direction.

A total of 317 specimens has been examined from the following seven locations in Kentucky: Crittenden Co.: 1) Coefield Creek at KY Hwy 723, 13.7 km W Marion INHS 259 (2 Aug 1973—4 ♂ I, 5 ♂ II, 3 ♀), INHS 7315 (22 Mar 2000—4 ♂ I, 1 ♂ II); 2) Claylick Creek at Claylick Creek Rd., 2.4 km SE Shelbys Store, INHS 8410 (20 Apr 2001—2 ♂ I, 12 ♂ II, 5 ♀); 3) Hurricane Creek at Glendale Creek Rd., off Co. Rd. 1668, USNM 176924 (5 May 1976—4 ♂ II, 1 juv. ♂, 1 ♀, 1 juv. ♀); Livingston Co.: 4) Type locality, Ferguson Creek at KY Hwy 70, 3.2 km E Smithland INHS 8398 (11 Apr 2001—holotype), INHS 8395 (11 Apr 2001—allotype), INHS 8396 (11 Apr 2001—morphotype), INHS 8397 (11 Apr 2001—5 ♂ I, 3 ♂ II, 2 ♀ paratypes), INHS 355 (25 Nov 1972—6 ♂ I, 6 ♂ II, 16 ♀), INHS 352 (16 Jan 1973—2 ♂ I, 8 juv. ♂, 4 ♀, 15 juv. ♀), INHS 356 (20 Feb 1973—2 ♂ I, 5 ♂ II, 11 ♀), INHS 343 (3 Mar 1973—5 ♂ I, 3 juv. ♂, 7 ♀, 1 juv. ♀), INHS 349 (23 Mar 1973—9 ♂ I, 3 juv. ♂, 1 ♀, 8 juv. ♀), INHS 347 (20 May 1973—2 ♂ II, 10 juv. ♂, 1 ♀, 2 juv. ♀), INHS 358 (19 Jun 1973—4 ♀), INHS 359 (21 Apr 1974—2 ♂ I, 10 juv. ♂, 3 ♀, 3 juv. ♀); 5) Foreman Creek at Lola INHS 334 (2 Aug 1973—45 juv. ♂, 31 juv. ♀); 6) Sandy Creek at KY Hwy 1433, 4.5 km

SW Salem INHS 8405 (20 Apr 2001—1 ♂ I, 9 ♂ II, 1 ♀); 7) Buck Creek 1.6 km E Joy INHS 338 (20 Jun 1973—2 ♂ I, 2 ♂ II, 9 juv. ♂, 2 ♀, 10 juv. ♀).

Etymology.—*margo* L. (=margin) + *rectus* L. (=straight). In reference to the straight edged margin of the incisor region of the mandible found on the species.

Habitat and life-history notes.—*Orconectes margorectus*, new species, occurs in small streams with substrates of cobble and gravel intermixed with mud. Within these streams, the species was most commonly encountered under flat cobble in areas of moderate flow. The cobble under which the species occurred was variable in size, ranging from 10 cm wide × 10 cm long to 25 cm wide × 25 cm long. At several sites the species was collected from woody debris piles in mid-channel or woody vegetation root masses along stream edges.

Form I males have been collected in the months of January, February, March, April, and November. Copulation most likely occurs in late fall or early winter as females with sperm plugs were observed in January and February collections. Ovigerous females have been collected in March and April. Ferguson Creek at the type locality (site #4 in above "Range and specimens examined" section) was sampled monthly between November 1972 and June 1973. Those collections failed to record ovigerous females after April.

Crayfish associates.—The following species were collected from habitats containing *O. margorectus*, new species: *Cambarus (Erebicambarus) tenebrosus* Hay, 1902, *Cambarus (Lacunicambarus) diogenes* Girard, 1852, and *Orconectes (Trisellecens) immunis* (Hagen, 1870).

Variation.—Several ontogenetic variations are observed in *O. margorectus*, new species, none of which show any geographic patterns of distribution. In some smaller individuals the proximal halves of the rostral margins are slightly convex. In form I males, the length of the mesial process of the first pleopod in comparison to the length

of the central projection is highly variable. In some individuals the mesial process is slightly shorter than the central projection while in others the mesial process is of equal length to the central projection. In addition, the number of palmar tubercles is variable, with either two or three rows being present.

Comparisons.—*Orconectes margorectus*, new species, differs from all other members of the genus *Orconectes* in possessing a unique combination of form I male pleopod and mandible characters. Other *Orconectes* species that possess a form I pleopod without a shoulder and have straight terminal elements approximately 24 to 28% of the total length of the pleopod include *O. (Crockerinus) eupunctus* Williams, 1952, *O. (C.) illinoiensis* Brown, 1956, *O. (C.) propinquus* (Girard, 1852), *O. (C.) rafinesquei* Rhoades, 1944, *O. (C.) sanbornii* (Faxon, 1884), and *O. (C.) tricuspis* Rhoades, 1944. *Orconectes margorectus* differs from all of these species in possessing a straight edged incisor region of the mandible (Fig. 2A), rather than an indented incisor region (Fig. 2B). While *O. (C.) jeffersoni* Rhoades, 1944 possesses a form I pleopod with short, straight terminal elements and a mandible with a straight edged incisor region, its terminal elements are longer than those of *O. margorectus*. *Orconectes jeffersoni*'s terminal elements average 32% of the total length of the pleopod while those of *O. margorectus* average 25%.

Relationships.—The form I male pleopod of *O. margorectus*, new species, is most similar in length and general shape to those of members of the subgenus *Crockerinus*, and *O. margorectus*, new species, is assigned to that subgenus. Fitzpatrick (1987) subdivided *Crockerinus* into five groups: *Sanbornii*, *Marchandi*, *Propinquus*, *Rafinesquei*, and *Shoupi*. Following Fitzpatrick's (1987) hypothesis that characters associated with amplexus are most useful for inferring phylogenetic relationships, *O. margorectus* most likely belongs to the Raf-

inesquei group. *Orconectes margorectus* shares with other members of the *Rafinesquei* group the following characters: central projection of form I male pleopod comprising 22 to 29% of total length of pleopod and distinct trough through cephalic half of annulus ventralis. The placement of *O. margorectus* in the *Rafinesquei* group also is supported biogeographically given that it occupies a range closer to those of other members of the *Rafinesquei* group than to other members of the subgenus. With the exception of *O. rafinesquei*, which inhabits the Rough River drainage of west-central Kentucky, all members of the *Rafinesquei* group occur in the lower Cumberland, Tennessee, and Ohio river drainages of extreme western Kentucky and southern Illinois (Hobbs 1989). Given the overall similarity in pleopod, rostrum, and chela shape, I hypothesize that the closest relative of *O. margorectus* to be *O. rafinesquei*. Future analyses using a combined data set of both molecular and morphological characters should help elucidate the relationships within the subgenus *Crockerinus*.

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